9th Class 2021		
Physics	Group-II	Paper-I
Time: 1.45 Hours	(Subjective Type)	Marks: 48

(Part-I)

2. Write short answers to any FIVE (5) questions: (10)

(i) Write any four names of base quantity.

Ans The four base quantities are as follows:

1. Length
2. Mass
3. Time
4. Electric current

(ii) What do you mean by scientific notation? Give example.

Ans A simple but scientific way to write large or small numbers is to express them in some power of ten. The moon is 38,40,00,000 meters away from the Earth. Distance of the moon from the Earth can also be expressed as 3.84×10^8 m. This form of expressing a number is called the scientific notation.

(iii) What is meant by vernier constant?

Ans Vernier constant or least count is the minimum distance that can be measured with the help of vernier callipers.

(iv) Differentiate between scalars and vectors.

Ans A physical quantity which can be completely described by its magnitude is called a scalar. A vector can be described completely by magnitude along with its direction.

(v) Define acceleration and write its formula.

Ans Acceleration is defined as the rate of change of velocity of a body.

$$\text{Acceleration} = \frac{\text{change in velocity}}{\text{time taken}}$$

$$\text{Acceleration} = \frac{\text{final velocity} - \text{initial velocity}}{\text{time taken}}$$

$$a = \frac{v_f - v_i}{t}$$

(vi) Describe a vector by graphically method.

Ans Graphically, a vector can be represented by a line segment with an arrow head. In figure, the line AB with arrow

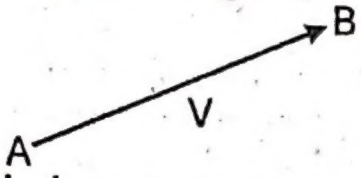

Fig. Graphical representation of a vector V.

head at B represents a vector V. The length of the line AB gives the magnitude of the vector V on a selected scale. While the direction of the line from A to B gives the direction of the vector V.

(vii) Define force and write its unit.

Ans A force moves or tends to move, stops or tends to stop the motion of a body. The unit of force is the Newton and denoted by symbol N.

(viii) What is meant by coefficient of friction? Also write its symbol.

Ans The ratio between the force of limiting friction F_s and the normal reaction R is constant. This constant is called the coefficient of friction and is represented by μ.

$$\mu = \frac{F_s}{R}$$

3. Write short answers to any FIVE (5) questions: 10

(i) What is meant by resultant force?

Ans A resultant force is a single force that has the same effect as the combined effect of all the forces to be added.

(ii) Define moment arm.

Ans The perpendicular distance between the axis of rotation and the line of action of the force is called moment arm of the force.

(iii) State the principle of moments.

Ans According to the principle of moments:

A body is balanced if the sum of clockwise moments acting on the body is equal to the sum of anticlockwise moments acting on it.

(iv) What are artificial satellites?

Ans An object that revolves around a planet is called a satellite. The moon revolves around the Earth, so moon is a natural satellite of the Earth. Scientists have sent many objects into space. Some of these objects revolve around the Earth. These are called artificial satellites. Most of the artificial satellites, orbiting around the Earth, are used for communication purposes.

(v) What is meant by force of gravitation?

Ans Newton concluded that there exists a force due to which everybody of the universe attracts every other body. He named this force the force of gravitation.

(vi) What are natural satellites?

Ans A natural satellite or moon is, in the most common usage, an astronomical body that orbits a planet or minor planet. In solar system, there are six planetary satellites systems containing 185 known natural satellites.

(vii) Define kinetic energy and potential energy.

Ans The energy possessed by a body due to its motion is called its kinetic energy.

The energy possessed by a body due to its position is known as its potential energy.

(viii) How can you find the efficiency of system?

Ans **Efficiency:**

Efficiency of a system is the ratio of required form of energy obtained from a system as output to the total energy given to it as input.

Relation:

$$\text{Efficiency} = \frac{\text{Required form of output}}{\text{Total input energy}}$$

4. Write short answers to any FIVE (5) questions: 10

(i) Define density and given the density of water.

Ans Density of a substance is defined as its mass per unit volume.

$$\text{Density} = \frac{\text{mass of a substance}}{\text{volume of that substance}}$$

The density of water is 1000 Kg m^{-3}.

(ii) What is elasticity?

Ans The property of the solids because of which they restore their original shape when external force ceases to act.

(iii) Define stress and give its unit.

Ans The deforming force acting on unit area at the surface of a body is called stress.

$$\text{Thus, . Stress} = \frac{\text{Force}}{\text{Area}}$$

In SI, the unit of stress is newton per square metre (Nm^{-2}).

(iv) Define internal energy.

Ans The sum of kinetic energy and potential energy associated with the atoms, molecules and particles of a body is called its internal energy.

(v) What is meant by latent heat of vaporization?

Ans The quantity of heat that changes unit mass of a liquid completely into gas at its boiling point without any change in its temperature is called its latent heat of vaporization.

(vi) What are the three ways of transfer of heat? Write their names.

Ans There are three ways by which transfer of heat takes place. These are:

1. Conduction 2. Convection 3. Radiation

(vii) Define thermal conductivity.

Ans The rate of flow of heat across the opposite faces of a metre cube of a substance maintained at a temperature difference of one kelvin is called the thermal conductivity of that substance.

(viii) Write two uses of convection currents?

Ans Following are the two uses of convection currents:

1. Convection currents set up by electric, gas or coal heaters help to warm our homes and offices. Central heating systems in buildings work on the same principle by convection.
2. Convection currents occur on a large scale in nature.

(Part-II)

Note: Attempt any TWO (2) questions.

Q.5.(a) State and explain law of conservation of momentum. **(4)**

Ans The Law of Conservation of Momentum states that:

"The momentum of an isolated system of two or more than two interacting bodies remains constant."

Consider the example of an air-filled balloon as described under the third law of motion. In this case, balloon and the air inside it form a system. Before releasing the balloon, the system was at rest and hence the initial momentum of the system was zero. As soon as the balloon is set free, air escapes out of it with some velocity. The air coming out of it possesses momentum. To conserve momentum, the balloon moves in a direction opposite to that of air rushing out.

Consider an isolated system of two spheres of masses m_1 and m_2. They are moving in a straight line with initial velocities u_1 and u_2, respectively, such that u_1 is

greater than u_2. Sphere of mass m_1 approaches the sphere of mass m_2 as they move.

Initial momentum of mass $m_1 = m_1u_1$

Initial momentum of mass $m_2 = m_2u_2$

Total initial momentum of the system before collision $= m_1u_1 + m_2u_2$ (1)

After sometime, mass m_1 hits m_2 with some force. According to Newton's third law of motion, m_2 exerts an equal and opposite reaction force on m_1. Let their velocities become v_1 and v_2, respectively after collision. Then

Final momentum of mass $m_1 = m_1v_1$

Final momentum of mass $m_2 = m_2v_2$

Total final momentum of the system after collision $= m_1v_1 + m_2v_2$ (2)

According to the law of conservation of momentum

$$\begin{bmatrix}\text{Total initial momenutm of}\\ \text{the system before collision}\end{bmatrix} = \begin{bmatrix}\text{Total final momentum of}\\ \text{the system after collision}\end{bmatrix}$$

$$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2 \quad (3)$$

Equation (3) shows that the momentum of an isolated system before and after collisions remains the same which is the law of conservation of momentum. Law of conservation of momentum is an important law and has vast applications.

(b) A train starts from rest with an acceleration of 0.5 ms^{-2}. Find its speed in km h^{-1}, when it has moved through 100 m? (5)

Ans Initial velocity $= v_i = 0$

Acceleration $= a = 0.5\ ms^{-2}$

$S = 100$ m

Final velocity $= v_f = ?$

Formula: $2aS = v_f^2 - v_i^2$

$$2 \times 0.5 \times 100 = v_f^2 - 0$$

$$100 = v_f^2$$

or $$v_f^2 = 100$$

$$v_f = 10 \text{ ms}^{-1}$$

$$v_f = \frac{10 \times 60 \times 60}{1000} = \frac{36000}{1000} = 36 \text{ kmh}^{-1}$$

$$\boxed{v_f = 36 \text{ kmh}^{-1}}$$

Q.6.(a) Define equilibrium. State and explain first condition of equilibrium. (4)

Ans First Condition for Equilibrium:

A body is said to satisfy first condition for equilibrium if the resultant of all the forces acting on it is zero. Let n number of forces $F_1, F_2, F_3, \ldots, F_n$ are acting on a body such that

$$F_1 + F_2 + F_3 + \ldots + F_n = 0$$

or $$\Sigma F = 0 \quad \text{(i)}$$

The symbol Σ is a Greek letter called sigma used for summation. Equation (i) is called the first condition for equilibrium.

The first condition for equilibrium can also be stated in terms of x and y-components of the forces acting on the body as:

$$F_{1x} + F_{2x} + F_{3x} + \ldots + F_{nx} = 0$$

and $$F_{1y} + F_{2y} + F_{3y} + \ldots + F_{ny} = 0$$

or $$\Sigma F_x = 0 \quad \text{(ii)}$$

and $$\Sigma F_y = 0 \quad \text{(iii)}$$

A book lying on a table or a picture hanging on a wall, are at rest and thus satisfy first condition for equilibrium. A paratrooper coming down with terminal velocity (constant velocity) also satisfies first condition for equilibrium and is thus in equilibrium.

(b) **A motor boat moves at a steady speed of 4 ms^{-1}. Water resistance acting on it is 4000 N. Calculate the power of its engine.** **(5)**

Ans For Answer see Paper 2019 (Group-I), Q.6.(b).

Q.7.(a) State Pascal's law and derive an equation by using hydraulic press. **(4)**

Ans **Hydraulic Press:**

Hydraulic press is a machine which works on Pascal's law. It consists of two cylinders of different cross-sectional areas as shown in figure. They are fitted with pistons of cross-sectional areas a and A. The object to be compressed is placed over the piston of large cross-sectional area A. The force F_1 is applied on the piston of small cross-sectional area a. The pressure P produced by small piston is transmitted equally to the large piston and a force F_2 acts on A which is much larger than F_1.

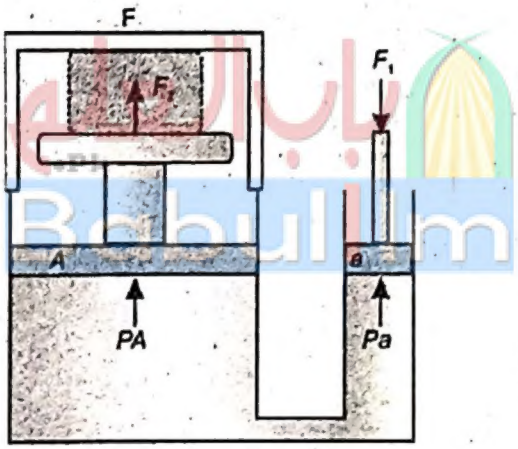

Fig. A hydraulic press.

Pressure on piston of small area a is given by

$$P = \frac{F_1}{a}$$

Apply Pascal's law, the pressure on large piston of area A will be the same as on small piston.

$$\therefore \quad P = \frac{F_2}{A}$$

Comparing the above equations, we get

$$\frac{F_2}{A} = \frac{F_1}{a}$$

$$\therefore \quad F_2 = A \times \frac{F_1}{a}$$

or $$F_2 = F_1 \times \frac{A}{a}$$

Since the ratio $\frac{A}{a}$ is greater than 1, hence the force F_2 that acts on the larger piston is greater than the force F_1 acting on the smaller piston. Hydraulic systems working in this way are known as force multipliers.

(b) Calculate the increase in the length of an aluminium bar 2 m long when heated from 0°C to 20°C. The thermal coefficient of linear expansion of aluminium is $2.5 \times 10^{-5}\ K^{-1}$. (5)

Ans For Answer see Paper 2021 (Group-I), Q.7.(b).